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(54) Title: COMPOSITION FOR IMPREGNATION OF FABRICS AND NETTINGS

(57) Abstract: There is provided an impregnated netting or fabric for insect or tick killing and repellence which comprises an insecticide and/or a repellant, and a film forming component which reduces wash off and degradation of the insecticide component from the netting or fabric. This is achieved by forming a water resistant and optionally an oil resistant film which is a molecular shield around the fibres incorporating the insecticide or the repellant, either by integration of the insecticide or the repellant in the film, or by forming a substantial continuous film surrounding the insecticide/repellant together with the fibre.

Composition for impregnation of fabrics and nettings

The invention relates to a pesticidal composition containing pesticidal components preferably for use against biting and nuisance insects and impregnated to fabric or netting. The composition comprises a pesticidal component from the groups of pyrethroids and other insecticides with a fast kill effect and preferably also a repellent effect, awash protective agent, a fixating agent, a solvent for the pesticide and optionally one or more detergents. The invention also relates to a process for the preparation of the pesticidal impregnation composition and curing to the fabric or netting.

Background for the invention

A number of different insects cause substantial problems as vectors and transmitters of infectious diseases affecting humans, and tremendous efforts are invested in controlling these insects. Efforts have been concentrated on controlling insects belonging to the order Diptera (covering mosquitoes, gnats, black flies, tsetse flies and other biting flies), Hemiptera (covering bed bugs) and Siphonaptera (covering fleas). Methods to control these insects include treating inner and outer surfaces of walls, air spraying, and recently also impregnation of curtains and bednets. The impregnation of curtains and bednets has the advantage that the surface area to be treated is much reduced compared to a surface spraying of a house. The impregnation of the bednet reduces nuisance during sleeping and has been shown to be effective even if the net is slightly torn due to use. Several studies have shown that mosquitoes belonging to the genera Anopheles and Culex preferably bite during night time and that oviparous mosquitoes (i.e. mosquitoes that have passed at least one egg laying cycle and thus have bitten at least once, therefore potentially infected with a disease) bite closer to midnight than nulliparous (first time biting) females. Accordingly, bednets protect even better against disease transmitting mosquitoes than against nuisance caused by the same species since first time biters cannot be infected. Contrary to that, they do not protect against mosquitoes of the genus Aedes, black flies and species of biting flies that bite during daytime and for some species, only out door. Cloth impregnated with an insecticide and/or a repellant can provide protection against these insects and also reduce bites from night active insects when the person is not under the protection of the bednet.

The effect of a netting or fabric impregnated with a pyrethroid is partly based on the fast insecticidal property of these insecticides, but also on the repellent effect inherent in most of these insecticides. Tests have shown (Vincent et al.) that an impregnated bednet reduce the number of mosquitoes entering the room with up till 75 %. Thereby, the net also provides some protection for other persons sleeping in the same room even they are not covered by the net.

Large scale field experiment with netting have shown that they may reduce malaria infection rate as measured directly or indirectly as gross children mortality. Accordingly, netting has been selected as a priority area for the campaign against malaria and other mosquito born diseases by WHO, the World Health Organization.

In some areas mosquitoes are resistant to pyrethroids. One of these resistance types, so-called knock down resistance or kdr, also provides resistance to the repellent effect (Chandre et al., Hodjati and Curtis, 1999). This allows the mosquitoes to rest for a longer time on the net and thus to accumulate a lethal dosage of the insecticide, but it also gives the mosquitoes the possibility to bite before dying (Skovmand, unpublished information). In areas where these mosquitoes are dominating, a repellant can be added to the net with great advantage.

The advantages of the impregnated nets, curtains and fabric disappear at washing since these oils are washed off with reduced effect as a consequence. The fabric or netting must then be re-impregnated according to washing rate (Lines, 1996), but this have in practice shown to be very difficult to organise, especially in remote African villages. Therefore, an impregnation method that provides wash resistance will prolong the period of protection of the net and promote their use.

In some areas, people sleep outdoor during the hot season of the year and the nets thus risk to exposed to UV light. Some pyrethroids degrade slower than others in the presence of UV light, but none of them are very resistant. The addition of UV protection can thus prolong the protection of the net.

The generally and world wide preferred material for bednets are cotton and polyester. Nets of polyester has been chosen by WHO as the favourite material for bednets due to

their better strength, their cotton like feeling and reduced flammability. Opposite to that, nets of nylon and polyethylene are stiff and nylon is flammable.

Among the current formulations of pesticides for the impregnation of netting, only one method provides a long termed protection (Sumitomo, "Olyset"). This product is based on a monomer polyethylene fibre that is impregnated during formation of the fibre. The method cannot be used for the impregnation of a polyester fibre that is produced at temperatures destructive for the pyrethroids. Further, the resulting nets are sold at prices that are too high for people in poor countries.

Several methods can be used for the impregnation of fabric. In general, these methods take advantage of the tight structure of fabric and cannot be used on the smooth, open structure of a polyester net.

US Patent No. 4,056,610 (Barber, et al.), the invention provides for a microcapsular insecticidal composition comprising a pyrethroid and a biological synergist capable of controlling insects for up to four (4) days. This cannot be named residual activity, since a simple solution of a pyrethroid on polyester provides longer, residual activity.

US Patent No. 4,765,982 (Ronning) relates to compositions, devices and methods for controlling insect activity wherein an insect control agent is self-adhered to a rough-surfaced fibre and provides extended control of insect activity. The microencapsulated insect control agents disclosed in US Pat 4,056,610 are mentioned as the preferred insecticide for use in the invention. The invention relates to the production of a device made of rough cellulosic fibres.

US 5.089.298 (McNally and Samson) teaches that the addition of amylopectine to garment with permethrin offers some wash off protection. However, this binder is water soluble and will only give a poor protection in a polyester netting.

US 5,198,287 (Samson) relates to a tent fabric coated on the inside with a composition which renders it water repellent, flame retardant and insect repellant using permethrin as the insect repellant. Permethrin is incorporated in the inside impregnation of the tent thus protected against sun and atmospheric breakdown. The polymer used for the outside of the tent is coated with a composition, which renders it water repellent and flame retardant.

The insect-repellant composition on the inner side of the tent has an effective life of more than six (6) months. The invention basically relates to tents and the use of permethrin as a combined insect repellant and insecticide and the protection against UV breakdown of the permethrin by applying it to the inside of a tent. The examples given show that the polymers used are acrylic copolymers with zirconium wax for mobilising the permethrin in the polymer.

EP-A 0 731 208 (Samson) teaches that the dosage of 1.25g Permethrin/m² in fabric is strong enough to repel insects and that the addition of a polyvinyl acetate binder preserves the insecticidal effect of permethrin through several wash cycles. This process is claimed to be more effective than that covered by US Pat 5.089.298, a patent of the same author. Polymerisation of polyvinyl acetate result in a rather stiff film as known from "plastic paintings" (that are normally based on this chemical). The net has no longer a "cotton feeling". The patent discloses the use of polyvinyl acetate as a wash-resistance agent to protect an impregnation with permethrin.

WO 95/17091 (Tucci) teaches on the slow release from starch encapsulated slow release formulations of DEET. Adhesion of the starch capsules may be improved by cross-linking to the fabric and their wash resistance can be improved by adding a silicone polymer. The patent covers formulations where the principle is based on starch encapsulation of DEET.

EP 0 787 851 A1 (Samson, corresponds to US pat 5.631.072) teach on the wash resistant impregnation of fabric with a polymer binder and/or a cross-linking agent where the insecticide is added in an emulsion with a thickening agent. The patent discloses permethrin as the insecticide, polyvinyl acetate as the polymer and urethane resin as a cross-linking agent. The binder and the insecticide is tank mixed and added simultaneously, still using 1.25 g Permethrin/m² as dosage to obtain that the fabric is still insecticidal by contact after several washes. The invention also relates to use of the solutions on one side of the fabric only. The examples disclose an acrylic binder and the polymers given as examples are all plastics. The patent does not relate to the use of wash resistance based on film forming agents or molecular shields or the use on netting.

US 5,660,841 (Kraft) relates to a method for the producing of an insect-active assembly that can be attached to a garment. The patent follows the same principle as described in US 4,765,982 and claims an improved method for production to avoid high temperatures

during the production process, since these makes the DEET to evaporate or deteriorate. The patent refers to a US Pat 4,752,477 of the same author. The patent regards the production of a device and not impregnation of fabric or garment.

US 5,733,560 (Davister et al.) teaches the use of a chemical linker to link a range of organic compounds to a surface. The range includes insect repellants. The chemical linker is an ethoxylated glycerol compound, optionally a carbolic acid having 4-6 carbon atoms, a polyvinyl pyrrolidone and a polyethylene glycol having a molecular weight of 600 to 10,000. Our invention does not contain suck chemical linkers.

US 5,884,418 (Mc Nally) relates to a process and system for impregnating garments with insect repellant by placing the garment in tumbling machines with nozzles that spray a water emulsion containing permethrin onto the garment. This process is close to a dry cleaning process, and different from a process where the garment, fabric or netting is impregnated in a liquid (water with emulsion or solvent with solution) containing an insecticide composition or an insect repellant or a combination hereof. The process relates to garments and not to fabrics or nettings.

US 5,916,580 (Shober et al.) (equivalent to British Patent 9505653) relates to a method of controlling dust mites involving impregnating pre-formed netting with a liquid composition including a pyrethroid insecticide. The netting is applied around an article, such as a pillow, mattress, duvet, cushion, beanbag or domestic pet bed. The impregnation insecticide is a pyrethroid such as permethrin or deltamethrin. The claimed method consists of dipping a netting in a commercially available water emulsion of the pyrethroid and air-drying, i.e. the standard method for dipping bednets. This method does not provide fabric or netting able to resist many wash cycles, and the new perspective is only that it is used against dust mites.

US 5,930,909 (Mc Nally) is a continuation of US 5,884,418, but now several garments are impregnated at the same time and the process is controlled by use of a microprocessor.

Summary of the invention

Biting insects and mites are paralysed even after a short contact with a surface treated with some kinds of insecticides like pyrethroids and may even be repelled before the

contact. This combined ability can also be obtained by using the combination of an insecticide and a repellant. Fabric or netting impregnated with these active ingredients can therefore prevent the insects in biting or kill them after short contact. Several biting insects are vectors of diseases where the disease-causing agent has a ripening phase or a development within the insect before it becomes infective at a bite of the next host. When the garment is carried by a person or a net suspended around a bed or in a window or door, the attractive stimuli of the target is counteracted by the evaporated molecules of the insecticide or repellant and on contact with the garment or netting, excitatory contact repulsion effects are involved. For the netting and especially the garment, the choice of insecticide or repellant should not be irritating or intoxicating by contact or respiration. Irritation effect (coughing, headache) is often reported when using traditionally methods for impregnation with insecticides. In accordance with the present invention these effects can be counteracted by a surface coating that also provides wash resistance. Further, an UV inhibitor, reflector or absorber can be added to protect against deterioration of the insecticide and/or repellant.

Insects have been able to develop an inherited tolerance to insecticides: resistance. Resistance against pyrethroids has been found for several mosquito species, including Anopheles species. To avoid further build up of such resistance and to overcome the lack of efficacy when pyrethroid impregnated nets are used in areas with pyrethroid resistant or avoiding insects, other insecticides can be used either alone or in combination with a pyrethroid. For toxicological and registration reasons, the two insecticides should be applied on various parts of the net or fabric and not mixed and used homogeneously. A choice of alternative or supplementing insecticides can be taken from carbamates, organophosphorous or sterilising insecticides or other insecticides. Preferably, insecticides with low mammalian toxicity but high insect toxicity, low skin or eye irritation ability, low vapour pressure and low water solubility are applied.

Any surface impregnation will in the long run be washed off and it is therefore also interesting to add a soiling reducing surface treatment that will reduce the need for intensive washing of the garment or netting. The combination of a wash resistant treatment and a soiling resistant treatment can therefore further prolong the real effective life of the impregnation.

The present application relates to such a pesticidal or pesticidal-repellant composition that provides wash resistance, reduce irritability of the insecticide, reduce soiling, do not increase flammability and still leaves the fabric or netting with the same sensation of cloth and not stiffened. An UV agent can be added when relevant. The invention is not based on a polymer of polyvinyl acetate. The invention relates to the addition of a thin layer of a wash resistant agent that protects a layer of insecticide or insecticide-repellant or the protection is obtained by incorporation of the insecticide composition in the wash resistant agent. The composition may also be partly absorbed in an absorptive fabric. The added layer is so fine that it does not stiffen the fabric or netting.

The invention also relates to the process for preparation of the impregnation. This process may be of industrial scale using machines of the textile industry normally used for colouring or impregnation and this will give the most stable and homogenous results. One of the two types of compositions presented may also be used for simple hand dipping of garment or netting and will after horizontal drying result in an impregnation with reduced irritation and increased wash resistance as compared to traditional insecticide emulsions used for impregnation of netting. The method will not give the same homogenous distribution of impregnation as in the machine impregnation described in this invention.

Detailed description of the invention

The pesticidal composition according to the invention relates to a composition consisting of a pesticide or a pesticide and a repellant. The protective composition according to the invention relates to a single component or a mixture of components giving water or water and oil resistance. One or several detergents may be added to increase wettability of the agent to the fabric, to stabilise emulsions used, or to increase fixation. A cross-linking agent or a catalyser may be used to increase fixation. The pesticidal composition and the protective composition may be added successively (process 1) or in one process (process 2). An improved finish and curing may be obtained by finally passing a heated surface such as an iron or a heated roller or heating with hot air. An UV agent may be added during the process when needed in the final product.

In the present context, the term "pesticidal component" means any component having a pesticidal effect and being active in controlling or combating insects such as biting insects.

According to the present invention, the pesticidal component is preferably a pesticide with a fast paralysing or killing effect of the insect and very low mammalian toxicity. Preferred insecticides are insecticides belonging to the group of pyrethroid compounds, such as ethofenprox: 2-(4-ethoxyphenyl)-2-methylpropyl-3-phenoxybenzyl ether,

Fenvalerate: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2-(4-chlorophenyl)-3 methylbutyrate,

Esfenvalerate:(S)-alpha-cyano-3-phenoxybenzyl (S)-2-(4-chlorophenyl)-3-methylbutyrate,

Fenpropathrin: (RS)-alpha-cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate,

Cypermethrin: (RS)-alpha-cyano-3-phenoxybenzyl (1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,

Permethrin: 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,

Cyhalothrin: (RS)-alpha-cyano-3-phenoxybenzyl (Z)-(1RS)-cis-3- (2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopro panecarboxylate,

Deltamethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R)-cis-3-(2,2-dibromovinyl) -2,2-dimethylcyclopropanecarboxylate,

Cycloprothrin: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2,2-dichloro -1-(4-ethoxyphenyl)cyclopropanecarboxylate,

Fluvalinate (alpha-cyano-3-phenoxybenzyl N-(2-chloro-alpha,alpha,alpha-trifluoro-p-tolyl) -D-valinate),

Bifenthrin: (2-methylbiphenyl-3-ylmethyl)0(Z)-(1RS)-cis-3-(2-chloro-3,3,3-trifluoro-1-propenyl) -2,2-dimethylcyclopropanecarboxylate,

2-methyl-2-(4-bromodifluoromethoxyphenyl)propyl (3-phenoxybenzyl) ether,

Tralomethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis)3((1'RS)(1',2',2',2'-tetrabromoethyl)) -2,2-dimethylcyclopropanecarboxylate,

Silafluofen: 4-ethoxyphenyl (3-(4-fluoro-3-phenoxyphenyl)propyl}dimethylsilane,

D-fenothrin: 3-phenoxybenzyl (1R)-cis, trans)-chrysanthemate,

Cyphenothrin: (RS)-alpha-cyano-3-phenoxybenzyl (1R-cis, trans)-chrysanthemate, D-resmethrin: 5-benzyl-3-furylmethyl (1R-cis, trans)-chrysanthemate,

Acrinathrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis(Z))-(2,2-dimethyl-3- (oxo-3-(1,1,1,3,3,3-hexafluoropropyloxy)propenyl(cyclopropanecarboxylate,

Cyfluthrin: (RS)-alpha-cyano-4-fluoro-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,

Tefluthrin: 2,3,5,6-tetrafluoro-4-methylbenzyl (1RS-cis (Z))-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarbo xylate,
Transfluthrin: 2,3,5,6-tetrafluorobenzyl (1R-trans)-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate,
Tetramethrin: 3,4,5,6-tetrahydrophthalimidomethyl (1RS)-cis, trans-chrysanthemate,
Allethrin: (RS)-3-allyl-2-methyl-4-oxocyclopent-2-enyl (1RS)-cis, trans-chrysanthemate,
Prallethrin: (S)-2-methyl-4-oxo-3-(2-propynyl)cyclopent-2-enyl (1R)-cis, trans-chrysanthemate,
Empenthrin: (RS)-1-ethynyl-2-methyl-2-pentenyl (1R)-cis,trans-chrysanthemate,
Imiprothrin: 2,5-dioxo-3-(prop-2-ynyl)imidazolidin-1-ylmethyl (1R)-cis, trans-2,2-dimethyl-3-(2-methyl-1-propenyl)-cyclopropanecarboxylate,
D-flamethrin: 5-(2-propynyl)-furfuryl (1R)-cis, trans-chrysanthemate, and 5-(2-propynyl)furfuryl 2,2,3,3-tetramethylcyclopropanecarboxylate.

Insects are capable of developing resistance, and mosquitoes and other biting insects have already been observed to develop resistance to pyrethroids. In such cases, it may be advantageous to replace the pyrethroid with another insecticide with a low mammalian toxicity or to impregnate a part of the mosquito net with a pyrethroid and a part of it with another insecticide. Such a combination may also be used in general as a strategy to delay resistance development. Care should be taken to combine insecticides that have little or no chance to develop cross resistance, e.g. where the development of resistance to one of them also confer resistance to the other even the two insecticides are of different type. Such alternative or supplemental insecticides may be compounds such as organophosphorous compounds including
Fenitrothion: O,O-dimethyl 0-(4-nitro-m-tolyl) phosphorothioate,
Diazinon: 0,0-diethyl-0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate,
Pyridaphenthion: 0-(1,6-dihydro-6-oxo-1-phenylpyrazidin-3-yl) 0,0-diethyl phosphorothioate,
Pirimiphos-Etyl: 0,0-diethyl 0-(2-(diethylamino) 6-methyl-pyrimidinyl) phosphorothioate,
Pirimiphos-Methyl: 0-[2-(diethylamino)-6-methyl-4pyrimidinyl] 0,0-dimethyl phosphorothioate,
Etrimphos: 0-6-ethoxy-2-ethyl-pyrimidin-4-yl-0,0-dimethyl-phosphorothioate, Fenthion: 0,0-dimethyl-0-[-3-methyl-4-(methylthio) phenyl phosphorothioate, Phoxim: 2-(diethoxyphosphinothoyloxyimino)-2-phenylacetonitrile,

Chlorpyrifos: 0,0-diethyl-0-(3,5,6-trichloro-2-pyrinyl) phosphorothioate, Chlorpyriphos-methyl: 0,0-dimethyl 0-(3,5,6-trichloro-2-pyridinyl) phosphorothioate, Cyanophos: 0,0-dimethyl 0-(4cyanophenyl) phosphorothioate,

Pyraclofos: (R,S)[4-chlorophenyl)-pyrazol-4-yl] -0-ethyl-S-n-propyl phosphorothioate,

Acephate: 0,S-dimethyl acetylphosphoroamidothioate,

Azamethiphos: S-(6-chloro-2,3-dihydro-oxo-1,3-oxazolo [4,5-b] pyridin-3-ylmethyl phosphorothioate,

Malathion: 0,0-dimethyl phosphorodithioate ester of diethyl mercaptosuccinate,

Temephos: (0,0'(thiodi-4-1-phenylene) 0,0,0,0-tetramethyl phosphorodithioate,

Dimethoate: ((0,0-dimethyl S-(n-methylcarbamoylmethyl) phosphorodithioate, Formothion: S[2-formylmethylamino]-2-oxoethyl]-O,O-dimethyl phosphorodithioate, Phenthoate: 0,0-dimethyl S-(alpha-ethoxycarbonylbenzyl)-phosphorodithioate;

Furthermore, carbamate compounds may be applied including compounds such as

Alanycarb: S-methyl-N[[N-methyl-N-[N-benzyl-N(2-ethoxy-carbonylethyl) aminothio]carbamoyl]thioacetimidate,

Bendiocarb: 2,2-dimethyl-1,3-benzodioxol-4yl- methylcarbamate),

Carbaryl (1-naphthyl N-methylcarbamate,

Isoprocarb: 2-(1-methylethyl) phenyl methylcarbamate,

Carbosulfan: 2,3 dihydro-2,2-dimethyl-7-benzofuranyl [(dibutylamino)thio]methylcarbamate,

Fenoxycarb: Ethyl[2-(4-phenoxyphenoxy)ethyl] carbamate,

Indoxacarb: Methyl-7-chloro-2,3,4a,5-tetrahydro-2-[methoxycarbonyl (-4-trifluoromethoxyphenyl)]

Propoxur: 2-isopropyloxyphenol methylcarbamate,

Pirimicarb: 2-dimethylamino-5,6-dimethyl-4-pyrimidinyl- dimethylcarbamate, Thidiocarb: Dimethyl N,N'(thiobis((methylimino)carbonoyloxy)bisethanimidiothioate),

Methomyl: S-methyl N-((methylcarbamoyl)oxy)thioacetamidate,

Ethiofencarb: 2-((ethylthio)methyl)phenyl methylcarbamate,

Fenothiocarb: S-(4-phenoxybutyl)-N,N-dimethyl thiocarbamate,

Cartap: S,S'-(2-5dimethylamino)trimethylene)bis (thiocarbamate)hydrochloride,

Fenobucarb: 2-sec-butylphenylmethyl carbamate,

XMC: 3,5-dimethylphenyl-methyl carbamate,

Xylylcarb: 3,4-dimethylphenylmethylcarbamate;

Where nets are used in mass campaigns the alternative or supplemental insecticide may also be an insecticide with a sterilising effect thus to sterilise the mosquitoes and avoid the next generation of mosquitoes. Such insecticides can be of the benzoyl urea group such as 1-(alfa-4-(chloro-alpha-cyclopropylbenzylidenamino-oxy)-p-tolyl)-3-(2,6-diflourobenzoyl)urea, Diflubenzuron: N-(((3,5-dichloro-4-(1,1,2,2-tetraflouroethoxy)phenylamino) carbonyl)2,6 diflouro benzamid, Triflumuron: 2-Chloro-N-(((4-(triflouromethoxy) phenyl)-amino-)carbonyl) benzamide, or a triazin such as N-cyclopropyl- 1,3,5 -triazine-2,4,6-triamin or other insecticides with a sterilizing effect on adult mosquitoes.

In process 1, the insecticide is dissolved in a proper solvent (acetone, hexane, heptane, ligroin and petroleum ether; aromatic hydrocarbon solvents such as benzene, toluene and xylene; halogenated hydrocarbon solvents such as chloroform, carbon tetrachloride, dichloroethane, chlorobenzene and dichlorobenzene; ether solvents such as diethyl ether, diisopropyl ether, dioxane, tetrahydrofuran and ethylene glycol dimethyl ether; ester solvents such as ethyl acetate and butyl acetate; nitro compounds such as nitroethane and Nitrobenzene; dimethylformamide; and mixtures thereof).

The insecticide can be a pyrethroid such as listed above or any other insecticide repellant or a mixture of an insecticide and a repellant such as dimethyl-toluamid. In addition, a repellant can be used alone.

The solution is transferred to alcohol or glycol (ethyl-alcohol, propylenglycol, etc.) and the fabric or netting passes through this bath. To reduce the amount of solvents used in the process, the fabric or netting passes two rollers or a roller against a fixed surface to squeeze off as much as possible of the fluid. The concentration of the pyrethroid in the solution is calculated on the amount of solution remaining in the fabric or on the netting after this process. The fabric or netting is then dried, e.g. by a passing air stream or in an oven. The fabric and especially the netting may be kept fixed under this process not to change shape. The temperature used in the drying process must be below 220°C, preferably below 100°C.

After drying, the fabric or netting passes a second bath where a solution or emulsion of the wash resistant agent is added. A cross binding or a catalysing agent may be added. This emulsion can be based on hydrocarbon such as mineral wax or oil, or based on a

silicone such as a silicon wax or oil, or based on a polyfluorocarbon oil or alcohol. The mineral or silicone emulsion will form a continuous film on the evaporation of the water. The fluorocarbon molecules form a physical barrier in a process called telomeresation, a unification of larger molecules of fluorocarbons directed by additives that form a lattice structure with the fluorocarbon units. The protective agent added must be of a kind that allows the pyrethroid to migrate through the agent to the surface of the film to be active against the insects on contact and by slow evaporation. Flour carbon protection is normally oil repellent, and the migration of the pyrethroid is only possible in a proper lattice structure.

In process 2, the insecticide or insecticide-repellant mixture is dissolved as above. This mixture is then mixed under stirring into a water emulsion of the wash protective agent eventually with the addition of catalytic or cross binding agent or into organic solution of the protective agent. For reasons of workers safety, a water emulsion is preferred if the process is not totally contained. One or several detergents may be added to stabilise the organic solution of the pesticide in the water emulsion and to ease wetting. An optimal concentration that allows for emulsion stability without reducing wash resistance has to be found. The level and type of detergent used to stabilise the insecticide in the water emulsion is dependent on the insecticide and the protective agent and the emulsifiers used in that mixture. After completely wetting, the fabric or netting may pass a press, e.g. comprising two rollers to reduce the amount of composition absorbed, or surplus composition is removed by centrifuging. The fabric or netting is finally dried as described above or dried by passing a warm surface as a warm roller. Alternatively, the fabric may be partly or totally air dried. e.g. under vacuum, and then passed between one or two heated rollers or a roller and a heated surface. For the netting, the temperature during the drying process must not exceed 220°C, and preferably be below 120° during air-drying and below 200°C during the passage between the heated rollers. For the fabric, these temperatures might be higher since the fabric absorbs more water and thus have a lower temperature during the evaporation than that defined by the air temperature or the temperature of the heated surface. This final drying at elevated process also serves to accelerate the orientation of the molecules of the wash protective agent to form a homogenous wash repellent film. This process is often named as the "curing".

This impregnation process may also take place in a modified colouring or wash machine. Whereas the process described above fits mostly to netting before cutting and sewing into

mosquito bednets, curtains, garments etc., the following process may be used after such finishing. The cloth, curtain, net or whatever finished made textile that are to be impregnated is put into a wash machine, modified wash machine or colouring machine, and the emulsion is added. The textile is completely wetted during the process, but fluid content may be reduced in a vacuum process or by centrifugation. The surplus fluid is recycled for further use. Since some fibres may retain the insecticide or protective agent and thus leave the recycled process water with a lower percentage of these agents, the concentration in the textile or the fluid must be measured and the fluid for recycling must be upgraded.

A typical amount of pesticide is between 0.001 and 5% (dry weight) of the (dry) weight of the fabric or netting dependent on the insecticidal efficacy of the insecticide. A preferred amount is between 0.05 and 1 % of the fabric or netting dependent on the insecticide. For a pyrethroid like deltamethrin or alphacypermethrin, the preferred amounts are between 0.05 and 0.3 % of the weight of fabric or netting. For a pyrethroid like permethrin or etofenprox, the preferred amount is between 0.1 and 6 %.

A typical amount of protective agent is between 0.001 and 10 % (dry weight) of the (dry) weight of the fabric or netting, depending on the chemical type of the protective agent. As a rule, the higher the amount of insecticide of a specific type to be added, the higher the concentration of the protective agent so that the ratio between insecticide and protective agent is approximately constant with a value depending on the insecticidal and migratory ability of the insecticide. For a silicone protection, the typical amount is between 0.01% and 2%, preferably between 0.05% and 0.5%. For a fluorocarbon protection, the typical amount is between 0.1% and 10 %, preferably between 0.5% and 3%. For a mineral oil (wax) protection, the typical amount is between 0.01% and 10 %, preferably between 0.2 and 5 %. Cross binding and linking agents and catalysers are typically added in a ratio of less than 1:1 based on the amount of protective agent. A polyurethane or polyacryl fixative may be added at a low concentration to increase the fixing of the insecticide. The fixative is added in the water emulsion with the flour carbon, mineral oil or silicon oil emulsion (or resin derivatives of flour carbons, mineral oils and silicon oils).

A typical amount of repellant used in combination with an insecticide or alone is 0.1% to 10% of the solvent or water emulsion, resulting in 0.001% to 1% of the impregnated netting or fabric on a dry weight basis.

Depending on the use of the final product, an UV filter may be added to prevent or reduce the inactivation of the sunlight of the insecticide and/or repellant. Such UV filters or reflectors may be para-aminobenzoic acid (PABA), Octyl Methoxycinnamate, stillbene brighteners, styryl or coumarin derivates, pyrazolin derivates, oxasol derivatives, benzaxo derivatives, 1,1'-Biphenyl-4,4'bis 2-(methoxypheny)ethenyl or other fluorescent whitening agents.

It is apparent from the foregoing brief description that the invented insect and tick wash resistant composition can be applied to fabric and nets in diverse ways. However, among the most useful products produced with these composition are impregnated nets and curtains, especially of polyester, and fabric of polyester, cotton, and silk used for light garments such as socks, trousers, shirts, i.e. garments used in body areas exposed to mosquito bites.

Accordingly, in one embodiment, the present invention relates to an impregnated netting or fabric for insect or tick killing and/or repellence of an insect or tick comprising

a) an insecticide and/or a repellant

(a) a film forming component reducing wash off and degradation of the insecticide component from the netting or fabric by forming a water and optionally an oil resistant film, the film being a molecular shield around the fibres incorporating the insecticide and or repellant either by integration of the insecticide/repellant in the film or by forming a substantial continuous film surrounding the insecticide/repellant together with the fibre.

The film forming component which are capable of forming a film resistant to water may include parafinic oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, and polyflourocarbon derivatives. These components will allow migration of the active ingredients in form of insecticides and/or repellants to migrate from the coating to the surface of the film with a sustained release of the active ingredient. The water resistance of the film will at the same time make the fabric or netting more resistant to wash off of the active ingredient. An oil resistant function may further reduce soiling of the fabrics or nettings and thereby decrease the need for washing.

In a preferred embodiment, the impregnated netting or fabric comprises a silicon oil or wax which is a polysiloxan.

In a further embodiment, the impregnated netting or fabric is one wherein the film forming component comprises a polymeric backbone selected from a resin, a polyurethane or a polyacryl. Preferable, the parafinic oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, or polyflourocarbon derivatives is attached to such polymeric backbone.

Accordingly, the migration and wash resistance may in one embodiment be obtained by mixing the parafinic oil derivatives and polyflourocarbon derivatives or by combining silicone oil or parafinic oil side chains with polyflourocarbon side chains on the same polymer backbone.

In a further embodiment, the impregnated netting or fabric according to the present invention also comprise one of more components selected from water, solvents, preservatives, detergents, stabilisers, agents having UV protecting properties, spreading agents, anti-migration agents, preservatives, foam forming agents, and soiling reducing agents. The soiling reducing agent is preferable selected from flourcarbons which is also a film forming agent according to the present invention. Accordingly, flourcabons may be added in case other film forming agents are used in order to reduce soiling of the impregnated product and to decrease wash off. The agents having UV protecting properties are preferably selected from UV filters or reflectors such as para-aminobenzoic acid (PABA), Octyl Methoxycinnamate, stillbene brighteners, styryl or coumarin derivates, pyrazolin derivates, oxasol derivatives, benzaxo derivatives, 1,1'-Biphenyl-4,4'bis 2-(methoxypheny)ethenyl or other fluorescent whitening agents.

In another useful embodiment more than one insecticide is applied in accordance with the invention. Accordingly, one part of the netting may e.g. be impregnated with one insecticide and another part with another insecticide thus to prevent insecticide resistance or obtain control when insecticide resistance is already present to one of them. The two insecticides should preferably belong to groups where cross resistance is not likely to play a major role.

In a further embodiment, the protecting film is further fixed by the addition of a fixating agent. An emulsion of the fixating agent is mixed with the emulsion of polyflorucarbon and

polysiloxan. Care must be taken that emulsifiers used in the various emulsions premade emulsions are compatible. The fixating agent may be a polyurethane or polyacryl. The fixating agent used alone will not contain and slow release the insecticide in a manner suitable for bednets.

It is generally preferred that the insect and tick killing and/or repelling composition that is used for impregnation of fabric and netting also contains a component to prevent UV degradation of the said active ingredients.

When the impregnation composition is a water emulsion of the active ingredients it is preferred to stabilise the emulsion with suitable detergents and preservatives to avoid physical or biological deterioration during long termed storage. Preservatives are especially important when the product according to the invention is a kit for impregnation or re-impregnation.

The impregnated netting or fabric according to the present invention may comprise the active ingredient in an amount from about 0.001% w/w to 95 %,w/w by weight, of the insecticide/repellant. In general the insecticide/repellant is used in an amount of 0.01% w/w to 10% w/w (weight of insecticide/weight of fabric).

The present invention relates to but are not limited to the following active insecticides selected from the group comprising pyrethroid compounds such as ethofenprox: 2-(4-ethoxyphenyl)-2-methylpropyl-3-phenoxybenzyl ether,
Fenvalerate: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2-(4-chlorophenyl)-3 methylbutyrate,
Esfenvalerate:(S)-alpha-cyano-3-phenoxybenzyl (S)-2-(4-chlorophenyl)-3-methylbutyrate,
Fenpropathrin: (RS)-alpha-cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate,
Cypermethrin: (RS)-alpha-cyano-3-phenoxybenzyl (1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Permethrin: 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Cyhalothrin: (RS)-alpha-cyano-3-phenoxybenzyl (Z)-(1RS)-cis-3- (2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopro panecarboxylate,

Deltamethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R)-cis-3-(2,2-dibromovinyl) -2,2-dimethylcyclopropanecarboxylate,

Cycloprothrin: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2,2-dichloro -1-(4-ethoxyphenyl)cyclopropanecarboxylate,

Fluvalinate (alpha-cyano-3-phenoxybenzyl N-(2-chloro-alpha,alpha,alpha-trifluoro-p-tolyl) -D-valinate),

Bifenthrin: (2-methylbiphenyl-3-ylmethyl)0(Z)-(1RS)-cis-3-(2-chloro-3,3,3-trifluoro-1-propenyl) -2,2-dimethylcyclopropanecarboxylate,

2-methyl-2-(4-bromodifluoromethoxyphenyl)propyl (3-phenoxybenzyl) ether,

Tralomethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis)3((1'RS)(1',2',2',2'-tetrabromoethyl)) -2,2-dimethylcyclopropanecarboxylate,

Silafluofen: 4-ethoxyphenyl (3-(4-fluoro-3-phenoxyphenyl)propyl}dimethylsilane,

D-fenothrin: 3-phenoxybenzyl (1R)-cis, trans)-chrysanthemate,

Cyphenothrin: (RS)-alpha-cyano-3-phenoxybenzyl (1R-cis, trans)-chrysanthemate, D-resmethrin: 5-benzyl-3-furylmethyl (1R-cis, trans)-chrysanthemate,

Acrinathrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis(Z))-(2,2-dimethyl-3- (oxo-3-(1,1,1,3,3,3-hexafluoropropyloxy)propenyl(cyclopropanecarboxylate,

Cyfluthrin: (RS)-alpha-cyano-4-fluoro-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,

Tefluthrin: 2,3,5,6-tetrafluoro-4-methylbenzyl (1RS-cis (Z))-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarbo xylate,

Transfluthrin: 2,3,5,6-tetrafluorobenzyl (1R-trans)-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate,

Tetramethrin: 3,4,5,6-tetrahydrophthalimidomethyl (1RS)-cis, trans-chrysanthemate,

Allethrin: (RS)-3-allyl-2-methyl-4-oxocyclopent-2-enyl (1RS)-cis, trans-chrysanthemate,

Prallethrin: (S)-2-methyl-4-oxo-3-(2-propynyl)cyclopent-2-enyl (1R)-cis, trans-chrysanthemate,

Empenthrin: (RS)-1-ethynyl-2-methyl-2-pentenyl (1R)-cis,trans-chrysanthemate,

Imiprothrin: 2,5-dioxo-3-(prop-2-ynyl)imidazolidin-1-ylmethyl (1R)-cis, trans-2,2-dimethyl-3-(2-methyl-1-propenyl)-cyclopropanecarboxylate,

D-flamethrin: 5-(2-propynyl)-furfuryl (1R)-cis, trans-chrysanthemate, and 5-(2-propynyl)furfuryl 2,2,3,3-tetramethylcyclopropanecarboxylate;

The presently preferred pyrethroid includes deltamethrin, etofenprox, alfacypermethrin, lambdacyhalothrin and cyfluthrin.

Other active insecticides that may be used alone or in combination, but preferably not mixed with pyretrhoids, are e.g. carbamate compounds such as alanycarb: S-methyl-N[[N-methyl-N-[N-benzyl-N(2-ethoxy-carbonylethyl) aminothio]carbamoyl]thioacetimidate,
Bendiocarb: 2,2-dimethyl-1,3-benzodioxol-4yl- methylcarbamate),
Carbaryl (1-naphthyl N-methylcarbamate,
Isoprocarb: 2-(1-methylethyl) phenyl methylcarbamate,
Carbosulfan: 2,3 dihydro-2,2-dimethyl-7-benzofuranyl [(dibutylamino)thio]methylcarbamate,
Fenoxycarb: Ethyl[2-(4-phenoxyphenoxy)ethyl] carbamate,
Indoxacarb: Methyl-7-chloro-2,3,4a,5-tetrahydro-2-[methoxycarbonyl (-4-trifluoromethoxyphenyl)]
Propoxur: 2-isopropyloxyphenol methylcarbamate,
Pirimicarb: 2-dimethylamino-5,6-dimethyl-4-pyrimidinyl- dimethylcarbamate, Thidiocarb: Dimethyl N,N'(thiobis((methylimino)carbonoyloxy)bisethanimidiothioate),
Methomyl: S-methyl N-((methylcarbamoyl)oxy)thioacetamidate,
Ethiofencarb: 2-((ethylthio)methyl)phenyl methylcarbamate,
Fenothiocarb: S-(4-phenoxybutyl)-N,N-dimethyl thiocarbamate,
Cartap: S,S'-(2-5dimethylamino)trimethylene)bis (thiocarbamate)hydrochloride,
Fenobucarb: 2-sec-butylphenylmethyl carbamate,
XMC: 3,5-dimethylphenyl-methyl carbamate,
Xylylcarb: 3,4-dimethylphenylmethylcarbamate,

Additionally, active insecticides such as organophosphorous compounds may be applied in accordance with the invention including compounds such as
Fenitrothion: O,O-dimethyl 0-(4-nitro-m-tolyl) phosphorothioate,
Diazinon: 0,0-diethyl-0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate,
Pyridaphenthion: 0-(1,6-dihydro-6-oxo-1-phenylpyrazidin-3-yl) 0,0-diethyl phosphorothioate,
Pirimiphos-Etyl: 0,0-diethyl 0-(2-(diethylamino) 6-methyl-pyrimidinyl) phosphorothioate,
Pirimiphos-Methyl: 0-[2-(diethylamino)-6-methyl-4pyrimidinyl] 0,0-dimethyl phosphorothioate,

Etrimphos: 0-6-ethoxy-2-ethyl-pyrimidin-4-yl-0,0-dimethyl-phosphorothioate, Fenthion: 0,0-dimethyl-0-[-3-methyl-4-(methylthio) phenyl phosphorothioate, Phoxim: 2-(diethoxyphosphinothoyloxyimino)-2-phenylacetonitrile,
Chlorpyrifos: 0,0-diethyl-0-(3,5,6-trichloro-2-pyrinyl) phosphorothioate, Chlorpyriphos-methyl: 0,0-dimethyl 0-(3,5,6-trichloro-2-pyridinyl) phosphorothioate, Cyanophos: 0,0-dimethyl 0-(4cyanophenyl) phosphorothioate,
Pyraclofos: (R,S)[4-chlorophenyl)-pyrazol-4-yl] -0-ethyl-S-n-propyl phosphorothioate,
Acephate: 0,S-dimethyl acetylphosphoroamidothioate,
Azamethiphos: S-(6-chloro-2,3-dihydro-oxo-1,3-oxazolo [4,5-b] pyridin-3-ylmethyl phosphorothioate,
Malathion: 0,0-dimethyl phosphorodithioate ester of diethyl mercaptosuccinate,
Temephos: (0,0'(thiodi-4-1-phenylene) 0,0,0,0-tetramethyl phosphorodithioate,
Dimethoate: ((0,0-dimethyl S-(n-methylcarbamoylmethyl) phosphorodithioate, Formothion: S[2-formylmethylamino]-2-oxoethyl]-O,O-dimethyl phosphorodithioate, Phenthoate: 0,0-dimethyl S-(alpha-ethoxycarbonylbenzyl)-phosphorodithioate.

Furthermore, active insecticides with a sterilising effect on adult mosquitoes may applied such as: 1-(alfa-4-(chloro-alpha-cyclopropylbenzylidenamino-oxy)-p-tolyl)-3-(2,6-diflourobenzoyl)urea, Diflubenzuron: N-(((3,5-dichloro-4-(1,1,2,2-tetraflouroethoxy)phenylamino) carbonyl)2,6 diflouro benzamid, Triflumuron: 2-Chloro-N-(((4-(triflouromethoxy) phenyl)-amino-)carbonyl) benzamide, or a triazin such as N-cyclopropyl- 1,3,5 -triazine-2,4,6-triamin; and

Additionally, the present invention also relates to a composition for impregnation of fabrics or nettings comprising

a) an insecticide and/or a repellant selected from the group comprising pyrethroid compounds such as ethofenprox: 2-(4-ethoxyphenyl)-2-methylpropyl-3-phenoxybenzyl ether,
Fenvalerate: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2-(4-chlorophenyl)-3 methylbutyrate,
Esfenvalerate:(S)-alpha-cyano-3-phenoxybenzyl (S)-2-(4-chlorophenyl)-3-methylbutyrate,
Fenpropathrin: (RS)-alpha-cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate,

Cypermethrin: (RS)-alpha-cyano-3-phenoxybenzyl (1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,

Permethrin: 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,

Cyhalothrin: (RS)-alpha-cyano-3-phenoxybenzyl (Z)-(1RS)-cis-3- (2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopro panecarboxylate,

Deltamethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R)-cis-3-(2,2-dibromovinyl) -2,2-dimethylcyclopropanecarboxylate,

Cycloprothrin: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2,2-dichloro -1-(4-ethoxyphenyl)cyclopropanecarboxylate,

Fluvalinate (alpha-cyano-3-phenoxybenzyl N-(2-chloro-alpha,alpha,alpha-trifluoro-p-tolyl) -D-valinate),

Bifenthrin: (2-methylbiphenyl-3-ylmethyl)0(Z)-(1RS)-cis-3-(2-chloro-3,3,3-trifluoro-1-propenyl) -2,2-dimethylcyclopropanecarboxylate,

2-methyl-2-(4-bromodifluoromethoxyphenyl)propyl (3-phenoxybenzyl) ether,

Tralomethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis)3((1'RS)(1',2',2',2'-tetrabromoethyl)) -2,2-dimethylcyclopropanecarboxylate,

Silafluofen: 4-ethoxyphenyl (3-(4-fluoro-3-phenoxyphenyl)propyl}dimethylsilane,

D-fenothrin: 3-phenoxybenzyl (1R)-cis, trans)-chrysanthemate,

Cyphenothrin: (RS)-alpha-cyano-3-phenoxybenzyl (1R-cis, trans)-chrysanthemate, D-resmethrin: 5-benzyl-3-furylmethyl (1R-cis, trans)-chrysanthemate,

Acrinathrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis(Z))-(2,2-dimethyl-3- (oxo-3-(1,1,1,3,3,3-hexafluoropropyloxy)propenyl(cyclopropanecarboxylate,

Cyfluthrin: (RS)-alpha-cyano-4-fluoro-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,

Tefluthrin: 2,3,5,6-tetrafluoro-4-methylbenzyl (1RS-cis (Z))-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarbo xylate,

Transfluthrin: 2,3,5,6-tetrafluorobenzyl (1R-trans)-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate,

Tetramethrin: 3,4,5,6-tetrahydrophthalimidomethyl (1RS)-cis, trans-chrysanthemate,

Allethrin: (RS)-3-allyl-2-methyl-4-oxocyclopent-2-enyl (1RS)-cis, trans-chrysanthemate,

Prallethrin: (S)-2-methyl-4-oxo-3-(2-propynyl)cyclopent-2-enyl (1R)-cis, trans-chrysanthemate,

Empenthrin: (RS)-1-ethynyl-2-methyl-2-pentenyl (1R)-cis,trans-chrysanthemate,

Imiprothrin: 2,5-dioxo-3-(prop-2-ynyl)imidazolidin-1-ylmethyl (1R)-cis, trans-2,2-dimethyl-3-(2-methyl-1-propenyl)-cyclopropanecarboxylate, D-flamethrin: 5-(2-propynyl)-furfuryl (1R)-cis, trans-chrysanthemate, and 5-(2-propynyl)furfuryl 2,2,3,3-tetramethylcyclopropanecarboxylate;

carbamate compounds such as alanycarb: S-methyl-N[[N-methyl-N-[N-benzyl-N(2-ethoxy-carbonylethyl) aminothio]carbamoyl]thioacetimidate, Bendiocarb: 2,2-dimethyl-1,3-benzodioxol-4yl- methylcarbamate), Carbaryl (1-naphthyl N-methylcarbamate, Isoprocarb: 2-(1-methylethyl) phenyl methylcarbamate, Carbosulfan: 2,3 dihydro-2,2-dimethyl-7-benzofuranyl [(dibutylamino)thio]methylcarbamate, Fenoxycarb: Ethyl[2-(4-phenoxyphenoxy)ethyl] carbamate, Indoxacarb: Methyl-7-chloro-2,3,4a,5-tetrahydro-2-[methoxycarbonyl (-4-trifluoromethoxyphenyl)] Propoxur: 2-isopropyloxyphenol methylcarbamate, Pirimicarb: 2-dimethylamino-5,6-dimethyl-4-pyrimidinyl- dimethylcarbamate, Thidiocarb: Dimethyl N,N'(thiobis((methylimino)carbonoyloxy)bisethanimidiothioate), Methomyl: S-methyl N-((methylcarbamoyl)oxy)thioacetamidate, Ethiofencarb: 2-((ethylthio)methyl)phenyl methylcarbamate, Fenothiocarb: S-(4-phenoxybutyl)-N,N-dimethyl thiocarbamate, Cartap: S,S'-(2-5dimethylamino)trimethylene)bis (thiocarbamate)hydrochloride, Fenobucarb: 2-sec-butylphenylmethyl carbamate, XMC: 3,5-dimethylphenyl-methyl carbamate, Xylylcarb: 3,4-dimethylphenylmethylcarbamate,

organophosphorous compounds such as Fenitrothion: O,O-dimethyl 0-(4-nitro-m-tolyl) phosphorothioate, Diazinon: 0,0-diethyl-0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate, Pyridaphenthion: 0-(1,6-dihydro-6-oxo-1-phenylpyrazidin-3-yl) 0,0-diethyl phosphorothioate, Pirimiphos-Etyl: 0,0-diethyl 0-(2-(diethylamino) 6-methyl-pyrimidinyl) phosphorothioate, Pirimiphos-Methyl: 0-[2-(diethylamino)-6-methyl-4pyrimidinyl] 0,0-dimethyl phosphorothioate,

Etrimphos: 0-6-ethoxy-2-ethyl-pyrimidin-4-yl-0,0-dimethyl-phosphorothioate, Fenthion: 0,0-dimethyl-0-[-3-methyl-4-(methylthio) phenyl phosphorothioate, Phoxim: 2-(diethoxyphosphinothoyloxyimino)-2-phenylacetonitrile,
Chlorpyrifos: 0,0-diethyl-0-(3,5,6-trichloro-2-pyrinyl) phosphorothioate, Chlorpyriphos-methyl: 0,0-dimethyl 0-(3,5,6-trichloro-2-pyridinyl) phosphorothioate, Cyanophos: 0,0-dimethyl 0-(4cyanophenyl) phosphorothioate,
Pyraclofos: (R,S)[4-chlorophenyl)-pyrazol-4-yl] -0-ethyl-S-n-propyl phosphorothioate,
Acephate: 0,S-dimethyl acetylphosphoroamidothioate,
Azamethiphos: S-(6-chloro-2,3-dihydro-oxo-1,3-oxazolo [4,5-b] pyridin-3-ylmethyl phosphorothioate,
Malathion: 0,0-dimethyl phosphorodithioate ester of diethyl mercaptosuccinate,
Temephos: (0,0'(thiodi-4-1-phenylene) 0,0,0,0-tetramethyl phosphorodithioate,
Dimethoate: ((0,0-dimethyl S-(n-methylcarbamoylmethyl) phosphorodithioate, Formothion: S[2-formylmethylamino]-2-oxoethyl]-O,O-dimethyl phosphorodithioate, Phenthoate: 0,0-dimethyl S-(alpha-ethoxycarbonylbenzyl)-phosphorodithioate;

insecticides with a sterilizing effect on adult mosquitoes such as: 1-(alfa-4-(chloro-alpha-cyclopropylbenzylidenamino-oxy)-p-tolyl)-3-(2,6-diflourobenzoyl)urea, Diflubenzuron: N-(((3,5-dichloro-4-(1,1,2,2-tetraflouroethoxy)phenylamino) carbonyl)2,6 diflouro benzamid, Triflumuron: 2-Chloro-N-(((4-(triflouromethoxy) phenyl)-amino-)carbonyl) benzamide, or a triazin such as N-cyclopropyl- 1,3,5 -triazine-2,4,6-triamin; and

the repellant is selected from N,N-Diethyl-meta-toluamide(DEET), N,N-diethylphenylacetamide (DEPA), 1-(3-cyclohexen-1-yl-carbonyl)-2-methylpiperine, (2-hydroxymethylcyclohexyl) acetic acid lactone, (2-ethyl-1,3-hexandiol), indalone, Methylneodecanamide (MNDA), a pyrethroid not used for insect control such as {(+/-)-3-allyl-2-methyl-4-oxocylopent-2-(+)enyl-(+)trans-chrysantemate (Esbiothrin), a repellant derived from or identical with plant extracts like limonen, citronella, eugenol, (+)-Eucamalol (1), (-)-1-epi-eucamalol or crude plant extracts from plants like Eucalyptus maculata, Vitex rotundifolia,Cymbopogan martinii, Cymbopogan citratus (lemon grass), Cymopogan nartdus (citronella), and

b) a film forming agent selected from parafinic oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, and polyflourocarbon derivatives, and

the filmforming agent being capable of forming a continuous layer substantially enclosing the fibres of a fabric or of a netting.

Polysiloxanes have, as described above, shown excellent properties as a film forming polymer. The derivatives referred to as parafinic oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, and polyflourocarbon derivatives represent the addition of functional groups to the backbone of the molecule. Accordingly, the derivative in the present context relates to groups capable of attaching the polymer to the fabric inter alia by a chemical attachment. In another embodiment the derivative increases the film forming properties of the polymer. The filmforming agent may advantageously be amplified with a fixative agent for improved attachment. The fixative agent may be a polymer in the form of polyurethane or polyacryl.

Fabrics and nettings to be impregnated according to the present invention and by use of a composition as described herein, may be impregnated locally when the composition is delivered in the form of a kit comprising the relevant ingredients in a handy form. Any of the ingredients may be in the form of a premix comprising the insecticide and/or repellant together with the polymer or the two may be separated. In a preferred embodiment the kit is adapted for preparing a emulsion by adding water. The ingredients of the kit may accordingly be in the form of a dry composition such as a powder, a capsule, a tablet, or an effervescent tablet. In a further embodiment, the kit comprises an emulsion wherein water is added by the end-user. The emulsion may be a micro-emulsion which is generally very stable. The emulsion may be embodied in a capsule.

In a further embodiment, the invention relates to a process for impregnation of a fabric or a netting comprising

(a) forming a solution or a water emulsion of an insecticide and/or repellant and a polymer and passing the fabric or netting through the solution or emulsion or spraying the solution or emulsion onto the fabric or netting at a temperature within a range of 10-120°C,
or
applying an insecticide and/or repellant on the fabric or netting and passing the fabric through a polymer solution or emulsion to fixate and wash protect the insecticide
b) optionally removing surplus composition by pressing of the fabric or netting
c) drying the fabric passively or actively at a temperature within 20-150°C.

The surplus composition may alternatively be removed by centrifuging or vacuum pressure.

It will be appreciated, that in accordance with the invention, the fabric or netting may either be passed through the solution or emulsion, or the solution or emulsion may be passed through the net.

The emulsion may also be in the form of a foam which is applied to the fabric or netting. A foam comprises less water/solvent and the drying process may be very short. It should be noted that the drying process may be a passive drying as the process may be carried out in rather hot climates. An active drying process will normally be performed during high scale processing.

The net or fabric may also pass a roller that is partly dipped into the solution or emulsion and draw the solution or emulsion to the side of the net or fabric in contact with a roller.

As described in detail above, the solution or emulsion may further comprise one or more ingredients selected from detergents, stabilisers, agents having UV protecting properties, solvents, spreading agents, anti-migration agents, preservatives, foam forming agents, and anti-soiling agents.

Further agents to be used are anti-static, anti-calcareous agents, and anti-curling agents. Furthermore, the composition according to the invention may also be incorporated into detergent mixtures used for washing cloth or in rinse fabric conditioner (fabric softeners). It should be considered that most fabric softeners are based on cationic detergents and that these may degrade insecticides. Special formulation considerations should be taken in this respect.

The process may also involve use of the kit as describe herein, accordingly, the impregnating process may be carried out by the end user in a low-scale process.

Impregnation with the insecticide is carried out at temperatures below 200°C, preferably below boiling point of the solvent with the lowest boiling point to reduce evaporation during this process.

In the succeeding drying process, temperatures are below 200°C. The temperature choice is a function of the evaporation temperature and mobility of the insecticide in the formulation. The mobility of the insecticide is a function of the molecular formula and structure. With a formulation wherein the diffusion ability in the specific formulation is high and wherein the vapour pressure of the insecticide is high, a lower drying temperature is sufficient or required.

After drying, the netting or fabric further passes an impregnation process with a composition that reduce wash off, and eventually soiling and UV degradation. These ingredients may be dissolved in organic solvents, but are preferably in water emulsions. After transfer of the protecting agents, pressure or centrifugation removes surplus liquid. The fabric or netting is subsequently dried. This drying process may be prolonged continuously into a curing process during which the temperature may be more elevated. The drying process is below 200°C, preferably below 120°C for netting. The curing process is below 220°C, though a fast curing may take place at higher degrees. When the fabric is dense and thick, the ambient temperatures in the process may be higher than cited above as long as the temperature in the fabric does not exceed these limits. The curing process may also include or consist of passing the fabric or netting by a heated surface under pressure such as an iron or a heated roller. During drying processes and curing, the fabric or netting is mechanically fixated in a way to prevent change of the form.

The impregnation process consist of dissolving the insecticide composition in a solvent and mixing this solvent into the part of the composition that provides water repellence, reduced soiling and eventually reduced UV degradation. This part may be as mentioned be dissolved in a solvent or be a water emulsion. Detergents may be added to either of the phases to be mixed to ease and stabilise the final emulsion. The fabric or netting passes through the emulsion or solution and pressure or centrifugation removes surplus liquid. Subsequently, the fabric or netting is dried at temperatures below 200°C, preferably below 120°C for netting, and eventually finally cured and/or fixated. A part of the drying process may be under vacuum.

The curing process is below 220°C, though a fast curing may take place at higher degrees. When the fabric is dense and thick, the ambient temperatures in the process may be higher than cited about as long as the temperature in the fabric does not exceed

these limits. The curing process may also include or consist of passing the fabric or netting by a heated surface under pressure such as an iron or a heated roller. During drying processes and curing, the fabric or netting may be mechanically fixated in a way to prevent change of form.

The application of the insecticide and/or impregnation liquid may also be done by forming a foam of the emulsion with the composition and applying the foam on the netting or fabric. This process reduce the amount of liquid applied, and thus reduce the energy consumption during the succeeding drying process.

According to the present invention, the impregnation process may also be carried out with very simple equipment. The fabric or net is dipped into the water emulsion or solution containing the claimed insecticide/repellant and the protective agent(s), suitable detergents to ease wetting and to stabilise the emulsion/solution with the concentrations needed. The superfluous water is pressed out either by hands or by a simple roller, the fabric, garment or net is laid horizontally and dried, preferably in the shadow. The curing may be improved by ironing at temperatures below 200°C.

The impregnation may be carried out by applying the emulsion with a simple sprayer as used in agriculture or for house spraying in mosquito control campaigns. This method is an alternative method and is very likely to be used to re-impregnate nettings or fabric previously impregnated with less effective impregnations or not impregnated. During spray application, precautions must be taken to avoid inhalation as with other mixtures containing insecticides. In addition, solvent removed by evaporation, e.g. in a factory process, is preferably recycled.

In a further embodiment of the invention, the impregnation process as described herein may also take place before the fibres are spun, woven or knitted. The fibres impregnated according to the present invention relates to the single structure forming the garment. However, the impregnation may still be performed directly on the garment or on the final fabric. The preferred nettings according to the present invention is in one example, a net made of 36 filaments of 0.01 mm which is spun to a fibre. Subsequently, the fibre is knitted to a net or alternatively woven to a fabric. The polymer used according to the invention is capable of substantially encompass the filaments or spun fibres of the fabric resulting in a superior protection from wash off and at the same time allowing the active

ingredient to be released in an amount sufficient to perform the insect killing or repellent effect.

Examples

TABLE 1

Process temperature and +/- protective agent.	Data before washing		Data after 3 washes		Data after 6 washes	
	KD at 60 min	Mortality at 24 hours	KD at 60 min	Mortality at 24 hours	KD at 60 min	Mortality at 24 hours
200°C, -	10	5	0	0		
200°C, +	20	5				
180°C, +	0	5				
150°C,+	5	0				
120°C,+	100	35	0	0		
80°C, +	100	100	100	100	100	100
60°C,+	100	100	100	100	100	100
40°C,+	100	100	100	100	100	100
20°C,-	100	100	100	95	100	55
20°C,+	100	100	100	100	100	100

KD: Knock down, percentage mosquitoes paralysed after 60 minutes

The washing procedure is a standard procedure recommended by WHO and is performed by WHO's reference laboratory.

The effect of adding protective agent and proper process temperature is shown in Table 1. The pesticide tested was 0.20 g alphacypermethrin, the protecting agent was a reactive ethyl-hydrogen-silicone macroemulsion, and the process temperature was as indicated. All ingredients were added in one process, then dried at the temperature indicated. 200°C was used after complete drying at 60°C.

Alphacypermethrin	0.20 g
Silicon oil	0.18 g
Polypropylene glycol	0.20 g
Acetone	2.50 g
Ethanol	7.50 g
Detergent	0.02 g
Preservative	0.01 g
Water to 100 g	

TABLE 2

Process temperature and +/- protective agent	Data before washing		Data after 3 washes		Data after 6 washes	
	KD at 60 min	Mortality at 24 hours	KD at 60 min	Mortality at 24 hours	KD at 60 min	Mortality at 24 hours
200°C,+	19	0				
180°C,+	10	5				
150°C,+	75	25				
120°C,+	100	95	0	0		
80°C,+	100	100	100	100		
60°C,+	100	100	100	100		
20°C,+	100	100	100	100		

The same procedure as used above, but alphacypermethrin is replaced by deltamethrin. This insecticide tolerates better higher temperature regimes.

TABLE 3

Pesticide	Protecting agent	Process temp.	Curing temp.	Before Wash		After 3 washes	
				KD at 60 min	Mortality at 24 hours	KD at 60 min	Mortality at 24 hours
Alphacyper methrin	none	80°C	200°C	10%	5%		
Alphacyper methrin	Epoxideresin stabilised silicone oil	80°C	200°C	100%	40%	0%	0%
Alphacyper methrin	Epoxideresin stabilised silicone oil	80°C	none	100%	100%	20%	60%
Alphacyper methrin	Zirconium stabilized Parafin	80°C	200°C	85%	20%		
Alphacyper methrin	Zirconium stabilized Parafin	80°C	none	100%	100%		

When impregnation is carried out in two steps, the protection against elevated temperatures is often better than in a one step process. Still, high temperatures are destructive. In this table, insecticide impregnation was carried out at room temperature, followed by a drying process at 80°C to evaporate solvents, then by an impregnation with an emulsified protecting agent, then by a drying process at 80°C to evaporate solvents and water, and finally by a curing process at 200°C or no (extra) curing process. The last two columns shows that the curing obtained at the higher temperature is not good enough to retain the residual activity and overall, it gave better results avoiding a final curing at high temperature.

TABLE 4

Concentration of protective agent in composition	Temp 1 Celsius	Time 1 minutes	Temp 2	Time 2	KD % At 60 min	Mortality at 24 hr
6%	120	20	120	60	76	24
6%	120	40	120	60	57	24
6%	120	60	120	60	38	8
6%	120	40	120	60	57	24
6%	120	40	120	40	95	38
6%	120	40	120	60	57	24
6%	120	40	150	60	0	5
6%	120	40	180	60	0	0
3%	120	40	120	60	91	55
3%	120	40	150	60	5	5
3%	120	40	180	60	0	0
1.5%	120	40	120	60	100	60
1.5%	120	40	150	60	10	10
1.5%	120	40	180	60	0	0

Table 4 shows the results of various temperatures and concentrations regimes in a two step impregnation process. The tested insecticide is alphacypermethrin and the protective agent is a polysiloxan. The percentages given for the protective agent are concentrations of the polysiloxan emulsion in the impregnation solution. The results show that high temperature is most critical for the first phase of impregnation, and less for the second. However, increasing exposure time at high temperatures in the second process also results in reducing insecticidal effect. The high concentration of the protective agent (6 % in solution) gives low pesticidal effect (too much protection), and the lower concentrations are better. This is due to a too high protection of (or too much dilution of) the pesticide at higher concentrations of protective agent.

TABLE 5

Protective Agent	Final curing at 200°C	One Step Process	Two Step Process
		Mortality at 24 hours	Mortality at 24 hours
Polyflouro-carbon	No	91	100
Polyflourocarbon	Yes	80	20

The above table shows test with a kationic, urethane amplified polyflourocarbon and the pesticide alphacypermethrin, that is more temperature sensitive and therefore suited for temperature stress test. Contrary to other wash resistant agents tested, the polyflour carbons provided better protection against heating in the curing process after mixing of the dissolved pesticide into the protecting composition (a one-step process) than in a two step process. This may be due to the formation of a polyflourcarbon film on top of the layer of pesticide that allows little pyrethroid to penetrate to the surface. The film formation is not so effective at lower temperature.

TABLE 6

Conc. Of Prot.	No wash		After 3 washes		After 6 washes		After 9 washes		After 12 washes	
	KD % 60min	Mort 24 hr	KD % 60min	Mort 24 hr	KD % 60min	Mort 24 hr	KD % 60min	Mort 24 hr	KD % 60min	Mort 24 hr
0.6 %, 40°C	100	100	100	100	100	100	100	80	50	0
0.6 % 60°C	100	100	100	100	100	100	100	80	55	25
0.3 % 40°C	100	100	100	100	100	100	100	100	95	40
0.3 % 60°C	100	100	100	100	100	100	100	100	100	70

The above Table 6 shows the results of test where the protective agent is an anionic polyflouralkyl emulsion with a parafinic oil -metal salt complex added. These mixtures are tested at two concentrations and two temperatures for the process and the pesticide deltamethrin. The impregnation is made in a one step process without high temperature curing . Wash resistance is obtained with 100 % effect for 9 washes and just slightly reduced for 12 washes, the resistance is slightly better at 40°C than at 60°C, probably due to better curing of the protective agent since other test showed that deltamethrin without any protection is not influenced by temperatures in the regime 80°C to 120°C.

The key point here is the mixture of the wash resistant agents. The parafinic oil-metal salt complex alone does not provide sufficient wash off protection as shown in table 3. The flouro-polycarbon impregnation alone is very effectively protecting against wash off, but also has oil-repellant abilities and allows for very little migration of the insecticide. As a result, very little insecticidal activity is obtained after washing that removes the pyrethroid already at the surface. The combination of the two provides at the same time a very effective wash-resistance and allow the pyrethroid to migrate.

TABLE 7

Polyflour-alkyl	Polysiloxan	Catalysator	UV-absorbant	Stability of Emulsion	Number of wash cycles resisted
4%	1 %	0.3		Stable	19
3.5 %	0.5	0.3		Separates	0
2.5 %	0	0		Stable	24
3.0 %	0	0		Stable	27
3.0	1.0	0.3	0,5	Stable	18
3.0	1.0	0.3	1,0	Unstable	5

The above Table 7 shows the results of stable emulsions versus unstable emulsions, where additives make the emulsions unstable at certain concentrations. Emulsifiers for stabilising the insecticide in the water solution must be compatible with emulsifiers used to emulsify the protective agents and additives in water. Proper stabilised and cured, the stable polyflour-alkyl-polysiloxan emulsions give resistance to 18-27 washes.

Examples of ranges of the ingredients used in the compositions according to the present invention are shown in the following:

With increasing concentration of insecticide, the concentration of polymer should also be increased so that the ratio between polymer and insecticide is substantial the same.

The amount of insecticide relative to the fabric is preferable in the range of 0.01% to 10% insecticide (weight insecticide/weight of fabric). The most effective insecticides are represented by deltamethrin and a less effective insecticide is represented by bendiocarb.

Specific compositions is shown in the following where Composition A represents a formulation wherein the fabric is impregnated with the insecticide before addition of the polymer composition. Composition B represents a composition wherein the pesticide is integrated into the polymer

However, the specific ranges may be varied according to the specific properties of the invention, in general the silicon oils is very effective and may used in lower dosages than the other polymers. The specific effectiveness of the insecticides is well known and is measured by the specific activity (mg insecticide/g insect)

Composition A	
Deltamethrin	0.30 g
Silicon oil	0.18 g
Polypropylonglycol	0.20 g
Detergent,	0.02 g
Preservative	0.01 g
Water to 100 g	

Composition B	
Deltamethrin	0.30 g
Acetone	2.50 g
Ethanol	10.00 g
Silicon resin oil	0.18 g
Polypropylenglycol	0.20 g
Detergent,	0.02 g

Preservative	0.01 g
Water to 100 g	

Composition C

Lambdacyhalothrin	0,30 g
Polyflourcarbon	0.10 g
Ethanol	10.00 g
Xylene	2.00 g
Acetic acid (60%)	0.60 g
Aluminium salt of paraffin oil	0.50 g
Detergent, emulsifiers and stabilizers	0.50 g
Polypropylenglycol	0.50 g
Water to 100 g	

Composition D

Deltamethrin	0,50 g
Polyflourcarbon	0.30 g
Ethanol	5.00 g
Acetone	2.00 g
Acetic acid (60%)	0.10 g
Detergent, emulsifiers, UV reflectant and stabilizers	1.50 g
Water to 100 g	

Use of additional ingredients, stabilisers, softeners, preservatives, UV protecting agents, curing, fixative and anti-migration agents, may be added individually depending of the desired properties of the formulation and may be performed by the skilled person

The impregnation compositions are used in the concentration in the range of from 10-70% in the solvent. The presently preferred solvent is water.

References

Hodjati, M. H. And Curtis, C.F. 1999. Evaluation of the effect of mosquito age and prior exposure to insecticide on pyrethroid tolerance in Anopheles mosquitoes (Diptera: Culicidae). Bull. Entomol. Research. 89, 329-337.

Lines, J. D. 1996. Technical issues regarding insecticide treated fabrics. Insecticide-treated Nets: the technology, its implementation, promotion and new research priorities (eds. C. Lengerer, J.A. Cattani, and D. de Savigny) IDRC Books , Ottawa.

CLAIMS

1. An impregnated netting or fabric for insect or tick killing and/or repellence of an insect or tick comprising

a) an insecticide and/or a repellant, and

b) a film forming component reducing wash off and degradation of the insecticide component from the netting or fabric by forming a water and optionally an oil resistant film, the film being a molecular shield around the fibres incorporating the insecticide and or repellant either by integration of the insecticide/repellant in the film or by forming a substantial continuous film surrounding the insecticide/repellant together with the fibre.

2. An impregnated netting or fabric according to claim 1 wherein the film forming component comprises one or more component selected from paraffin oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, and polyflourocarbon derivatives.

3. An impregnated netting or fabric according to claim 2 wherein the silicon oil or wax is a polysiloxan.

4. An impregnated netting or fabric according to claim 2 or 3 wherein the film forming component comprises a polymeric backbone selected from a resin, a polyurethane or a polyacryl.

5. An impregnated netting or fabric according to 3 wherein the paraffin oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, or polyflurocarbon derivatives is attached to the polymeric backbone.

6. An impregnated netting or fabric according to any of the preceding claims further comprising one of more components selected from water, solvents, preservatives, detergents, stabilisers, agents having UV protecting properties, spreading agents, anti-migration agents, preservatives, foam forming agents, and soiling reducing agents.

7. An impregnated netting or fabric according to any of the preceding claims comprising from about 0.001 to 95 %, by weight, of an insecticide.

8. An impregnated netting or fabric according to any of the preceding claims wherein the insecticide is selected from the group comprising:

pyrethroid compounds such as ethofenprox: 2-(4-ethoxyphenyl)-2-methylpropyl-3-phenoxybenzyl ether,
Fenvalerate: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2-(4-chlorophenyl)-3 methylbutyrate,
Esfenvalerate:(S)-alpha-cyano-3-phenoxybenzyl (S)-2-(4-chlorophenyl)-3-methylbutyrate,
Fenpropathrin: (RS)-alpha-cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate,
Cypermethrin: (RS)-alpha-cyano-3-phenoxybenzyl (1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Permethrin: 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Cyhalothrin: (RS)-alpha-cyano-3-phenoxybenzyl (Z)-(1RS)-cis-3- (2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopro panecarboxylate,
Deltamethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R)-cis-3-(2,2-dibromovinyl) -2,2-dimethylcyclopropanecarboxylate,
Cycloprothrin: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2,2-dichloro -1-(4-ethoxyphenyl)cyclopropanecarboxylate,
Fluvalinate (alpha-cyano-3-phenoxybenzyl N-(2-chloro-alpha,alpha,alpha-trifluoro-p-tolyl) -D-valinate),
Bifenthrin: (2-methylbiphenyl-3-ylmethyl)0(Z)-(1RS)-cis-3-(2-chloro-3,3,3-trifluoro-1-propenyl) -2,2-dimethylcyclopropanecarboxylate,
2-methyl-2-(4-bromodifluoromethoxyphenyl)propyl (3-phenoxybenzyl) ether,
Tralomethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis)3((1'RS)(1',2',2',2'-tetrabromoethyl)) -2,2-dimethylcyclopropanecarboxylate,
Silafluofen: 4-ethoxyphenyl (3-(4-fluoro-3-phenoxyphenyl)propyl}dimethylsilane,
D-fenothrin: 3-phenoxybenzyl (1R)-cis, trans)-chrysanthemate,
Cyphenothrin: (RS)-alpha-cyano-3-phenoxybenzyl (1R-cis, trans)-chrysanthemate, D-resmethrin: 5-benzyl-3-furylmethyl (1R-cis, trans)-chrysanthemate,
Acrinathrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis(Z))-(2,2-dimethyl-3- (oxo-3-(1,1,1,3,3,3-hexafluoropropyloxy)propenyl(cyclopropanecarboxylate,

Cyfluthrin: (RS)-alpha-cyano-4-fluoro-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Tefluthrin: 2,3,5,6-tetrafluoro-4-methylbenzyl (1RS-cis (Z))-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarbo xylate,
Transfluthrin: 2,3,5,6-tetrafluorobenzyl (1R-trans)-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate,
Tetramethrin: 3,4,5,6-tetrahydrophthalimidomethyl (1RS)-cis, trans-chrysanthemate,
Allethrin: (RS)-3-allyl-2-methyl-4-oxocyclopent-2-enyl (1RS)-cis, trans-chrysanthemate,
Prallethrin: (S)-2-methyl-4-oxo-3-(2-propynyl)cyclopent-2-enyl (1R)-cis, trans-chrysanthemate,
Empenthrin: (RS)-1-ethynyl-2-methyl-2-pentenyl (1R)-cis,trans-chrysanthemate,
Imiprothrin: 2,5-dioxo-3-(prop-2-ynyl)imidazolidin-1-ylmethyl (1R)-cis,
trans-2,2-dimethyl-3-(2-methyl-1-propenyl)-cyclopropanecarboxylate,
D-flamethrin: 5-(2-propynyl)-furfuryl (1R)-cis, trans-chrysanthemate, and 5-(2-propynyl)furfuryl 2,2,3,3-tetramethylcyclopropanecarboxylate;

carbamate compounds such as alanycarb: S-methyl-N[[N-methyl-N-[N-benzyl-N(2-ethoxy-carbonylethyl) aminothio]carbamoyl]thioacetimidate,
Bendiocarb: 2,2-dimethyl-1,3-benzodioxol-4yl- methylcarbamate),
Carbaryl (1-naphthyl N-methylcarbamate,
Isoprocarb: 2-(1-methylethyl) phenyl methylcarbamate,
Carbosulfan: 2,3 dihydro-2,2-dimethyl-7-benzofuranyl
[(dibutylamino)thio]methylcarbamate,
Fenoxycarb: Ethyl[2-(4-phenoxyphenoxy)ethyl] carbamate,
Indoxacarb: Methyl-7-chloro-2,3,4a,5-tetrahydro-2-[methoxycarbonyl (-4-trifluoromethoxyphenyl)]
Propoxur: 2-isopropyloxyphenol methylcarbamate,
Pirimicarb: 2-dimethylamino-5,6-dimethyl-4-pyrimidinyl- dimethylcarbamate, Thidiocarb: Dimethyl N,N'(thiobis((methylimino)carbonoyloxy)bisethanimidiothioate),
Methomyl: S-methyl N-((methylcarbamoyl)oxy)thioacetamidate,
Ethiofencarb: 2-((ethylthio)methyl)phenyl methylcarbamate,
Fenothiocarb: S-(4-phenoxybutyl)-N,N-dimethyl thiocarbamate,
Cartap: S,S'-(2-5dimethylamino)trimethylene)bis (thiocarbamate)hydrochloride,
Fenobucarb: 2-sec-butylphenylmethyl carbamate,
XMC: 3,5-dimethylphenyl-methyl carbamate,

Xylylcarb: 3,4-dimethylphenylmethylcarbamate,

organophosphorous compounds such as
Fenitrothion: O,O-dimethyl 0-(4-nitro-m-tolyl) phosphorothioate,
Diazinon: 0,0-diethyl-0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate,
Pyridaphenthion: 0-(1,6-dihydro-6-oxo-1-phenylpyrazidin-3-yl) 0,0-diethyl phosphorothioate,
Pirimiphos-Etyl: 0,0-diethyl 0-(2-(diethylamino) 6-methyl-pyrimidinyl) phosphorothioate,
Pirimiphos-Methyl: 0-[2-(diethylamino)-6-methyl-4pyrimidinyl] 0,0-dimethyl phosphorothioate,
Etrimphos: 0-6-ethoxy-2-ethyl-pyrimidin-4-yl-0,0-dimethyl-phosphorothioate, Fenthion: 0,0-dimethyl-0-[-3-methyl-4-(methylthio) phenyl phosphorothioate, Phoxim: 2-(diethoxyphosphinothoyloxyimino)-2-phenylacetonitrile,
Chlorpyrifos: 0,0-diethyl-0-(3,5,6-trichloro-2-pyrinyl) phosphorothioate, Chlorpyriphos-methyl: 0,0-dimethyl 0-(3,5,6-trichloro-2-pyridinyl) phosphorothioate, Cyanophos: 0,0-dimethyl 0-(4cyanophenyl) phosphorothioate,
Pyraclofos: (R,S)[4-chlorophenyl)-pyrazol-4-yl] -0-ethyl-S-n-propyl phosphorothioate,
Acephate: 0,S-dimethyl acetylphosphoroamidothioate,
Azamethiphos: S-(6-chloro-2,3-dihydro-oxo-1,3-oxazolo [4,5-b] pyridin-3-ylmethyl phosphorothioate,
Malathion: 0,0-dimethyl phosphorodithioate ester of diethyl mercaptosuccinate,
Temephos: (0,0'(thiodi-4-1-phenylene) 0,0,0,0-tetramethyl phosphorodithioate,
Dimethoate: ((0,0-dimethyl S-(n-methylcarbamoylmethyl) phosphorodithioate, Formothion: S[2-formylmethylamino]-2-oxoethyl]-O,O-dimethyl phosphorodithioate, Phenthoate: 0,0-dimethyl S-(alpha-ethoxycarbonylbenzyl)-phosphorodithioate;

insecticides with a sterilising effect on adult mosquitoes such as: 1-(alfa-4-(chloro-alpha-cyclopropylbenzylidenamino-oxy)-p-tolyl)-3-(2,6-diflourobenzoyl)urea, Diflubenzuron: N-(((3,5-dichloro-4-(1,1,2,2-tetraflouroethoxy)phenylamino) carbonyl)2,6 diflouro benzamid,
Triflumuron: 2-Chloro-N-(((4-(triflouromethoxy) phenyl)-amino-)carbonyl) benzamide, or a triazin such as N-cyclopropyl- 1,3,5 -triazine-2,4,6-triamin; and

the repellant is selected from N,N-Diethyl-meta-toluamide(DEET), N,N-diethylphenylacetamide (DEPA), 1-(3-cyclohexen-1-yl-carbonyl)-2-methylpiperine, (2-hydroxymethylcyclohexyl) acetic acid lactone, (2-ethyl-1,3-hexandiol), indalone,

Methylneodecanamide (MNDA), a pyrethroid not used for insect control such as {(+/-)-3-allyl-2-methyl-4-oxocylopent-2-(+)enyl-(+)trans-chrysantemate (Esbiothrin), a repellant derived from or identical with plant extracts like limonen, citronella, eugenol, (+)-Eucamalol (1), (-)-1-epi-eucamalol or crude plant extracts from plants like Eucalyptus maculata, Vitex rotundifolia,Cymbopogan martinii, Cymbopogan citratus (lemon grass), Cymopogan nartdus (citronella).

9. A composition for impregnation of fabrics or nettings comprising

a) an insecticide and/or a repellant wherein the insecticide is selected from the group comprising pyrethroid compounds such as ethofenprox: 2-(4-ethoxyphenyl)-2-methylpropyl-3-phenoxybenzyl ether,
Fenvalerate: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2-(4-chlorophenyl)-3 methylbutyrate,
Esfenvalerate:(S)-alpha-cyano-3-phenoxybenzyl (S)-2-(4-chlorophenyl)-3-methylbutyrate,
Fenpropathrin: (RS)-alpha-cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate,
Cypermethrin: (RS)-alpha-cyano-3-phenoxybenzyl (1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Permethrin: 3-phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Cyhalothrin: (RS)-alpha-cyano-3-phenoxybenzyl (Z)-(1RS)-cis-3- (2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopro panecarboxylate,
Deltamethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R)-cis-3-(2,2-dibromovinyl) -2,2-dimethylcyclopropanecarboxylate,
Cycloprothrin: (RS)-alpha-cyano-3-phenoxybenzyl (RS)-2,2-dichloro -1-(4-ethoxyphenyl)cyclopropanecarboxylate,
Fluvalinate (alpha-cyano-3-phenoxybenzyl N-(2-chloro-alpha,alpha,alpha-trifluoro-p-tolyl) -D-valinate),
Bifenthrin: (2-methylbiphenyl-3-ylmethyl)0(Z)-(1RS)-cis-3-(2-chloro-3,3,3-trifluoro-1-propenyl) -2,2-dimethylcyclopropanecarboxylate,
2-methyl-2-(4-bromodifluoromethoxyphenyl)propyl (3-phenoxybenzyl) ether,
Tralomethrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis)3((1'RS)(1',2',2',2'-tetrabromoethyl)) -2,2-dimethylcyclopropanecarboxylate,

Silafluofen: 4-ethoxyphenyl (3-(4-fluoro-3-phenoxyphenyl)propyl}dimethylsilane,
D-fenothrin: 3-phenoxybenzyl (1R)-cis, trans)-chrysanthemate,
Cyphenothrin: (RS)-alpha-cyano-3-phenoxybenzyl (1R-cis, trans)-chrysanthemate, D-resmethrin: 5-benzyl-3-furylmethyl (1R-cis, trans)-chrysanthemate,
Acrinathrin: (S)-alpha-cyano-3-phenoxybenzyl (1R-cis(Z))-(2,2-dimethyl-3- (oxo-3-(1,1,1,3,3,3-hexafluoropropyloxy)propenyl(cyclopropanecarboxylate,
Cyfluthrin: (RS)-alpha-cyano-4-fluoro-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate,
Tefluthrin: 2,3,5,6-tetrafluoro-4-methylbenzyl (1RS-cis (Z))-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarbo xylate,
Transfluthrin: 2,3,5,6-tetrafluorobenzyl (1R-trans)-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate,
Tetramethrin: 3,4,5,6-tetrahydrophthalimidomethyl (1RS)-cis, trans-chrysanthemate,
Allethrin: (RS)-3-allyl-2-methyl-4-oxocyclopent-2-enyl (1RS)-cis, trans-chrysanthemate,
Prallethrin: (S)-2-methyl-4-oxo-3-(2-propynyl)cyclopent-2-enyl (1R)-cis, trans-chrysanthemate,
Empenthrin: (RS)-1-ethynyl-2-methyl-2-pentenyl (1R)-cis,trans-chrysanthemate,
Imiprothrin: 2,5-dioxo-3-(prop-2-ynyl)imidazolidin-1-ylmethyl (1R)-cis, trans-2,2-dimethyl-3-(2-methyl-1-propenyl)-cyclopropanecarboxylate,
D-flamethrin: 5-(2-propynyl)-furfuryl (1R)-cis, trans-chrysanthemate, and 5-(2-propynyl)furfuryl 2,2,3,3-tetramethylcyclopropanecarboxylate;

carbamate compounds such as alanycarb: S-methyl-N[[N-methyl-N-[N-benzyl-N(2-ethoxy-carbonylethyl) aminothio]carbamoyl]thioacetimidate,
Bendiocarb: 2,2-dimethyl-1,3-benzodioxol-4yl- methylcarbamate),
Carbaryl (1-naphthyl N-methylcarbamate,
Isoprocarb: 2-(1-methylethyl) phenyl methylcarbamate,
Carbosulfan: 2,3 dihydro-2,2-dimethyl-7-benzofuranyl [(dibutylamino)thio]methylcarbamate,
Fenoxycarb: Ethyl[2-(4-phenoxyphenoxy)ethyl] carbamate,
Indoxacarb: Methyl-7-chloro-2,3,4a,5-tetrahydro-2-[methoxycarbonyl (-4-trifluoromethoxyphenyl)]
Propoxur: 2-isopropyloxyphenol methylcarbamate,
Pirimicarb: 2-dimethylamino-5,6-dimethyl-4-pyrimidinyl- dimethylcarbamate, Thidiocarb:
Dimethyl N,N'(thiobis((methylimino)carbonoyloxy)bisethanimidiothioate),

Methomyl: S-methyl N-((methylcarbamoyl)oxy)thioacetamidate,
Ethiofencarb: 2-((ethylthio)methyl)phenyl methylcarbamate,
Fenothiocarb: S-(4-phenoxybutyl)-N,N-dimethyl thiocarbamate,
Cartap: S,S'-(2-5dimethylamino)trimethylene)bis (thiocarbamate)hydrochloride,
Fenobucarb: 2-sec-butylphenylmethyl carbamate,
XMC: 3,5-dimethylphenyl-methyl carbamate,
Xylylcarb: 3,4-dimethylphenylmethylcarbamate,

organophosphorous compounds such as
Fenitrothion: O,O-dimethyl 0-(4-nitro-m-tolyl) phosphorothioate,
Diazinon: 0,0-diethyl-0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate,
Pyridaphenthion: 0-(1,6-dihydro-6-oxo-1-phenylpyrazidin-3-yl) 0,0-diethyl phosphorothioate,
Pirimiphos-Etyl: 0,0-diethyl 0-(2-(diethylamino) 6-methyl-pyrimidinyl) phosphorothioate,
Pirimiphos-Methyl: 0-[2-(diethylamino)-6-methyl-4pyrimidinyl] 0,0-dimethyl phosphorothioate,
Etrimphos: 0-6-ethoxy-2-ethyl-pyrimidin-4-yl-0,0-dimethyl-phosphorothioate, Fenthion: 0,0-dimethyl-0-[-3-methyl-4-(methylthio) phenyl phosphorothioate, Phoxim: 2-(diethoxyphosphinothoyloxyimino)-2-phenylacetonitrile,
Chlorpyrifos: 0,0-diethyl-0-(3,5,6-trichloro-2-pyrinyl) phosphorothioate, Chlorpyriphos-methyl: 0,0-dimethyl 0-(3,5,6-trichloro-2-pyridinyl) phosphorothioate, Cyanophos: 0,0-dimethyl 0-(4cyanophenyl) phosphorothioate,
Pyraclofos: (R,S)[4-chlorophenyl)-pyrazol-4-yl] -0-ethyl-S-n-propyl phosphorothioate,
Acephate: 0,S-dimethyl acetylphosphoroamidothioate,
Azamethiphos: S-(6-chloro-2,3-dihydro-oxo-1,3-oxazolo [4,5-b] pyridin-3-ylmethyl phosphorothioate,
Malathion: 0,0-dimethyl phosphorodithioate ester of diethyl mercaptosuccinate,
Temephos: (0,0'(thiodi-4-1-phenylene) 0,0,0,0-tetramethyl phosphorodithioate,
Dimethoate: ((0,0-dimethyl S-(n-methylcarbamoylmethyl) phosphorodithioate, Formothion: S[2-formylmethylamino]-2-oxoethyl]-O,O-dimethyl phosphorodithioate, Phenthoate: 0,0-dimethyl S-(alpha-ethoxycarbonylbenzyl)-phosphorodithioate;

insecticides with a sterilising effect on adult mosquitoes such as: 1-(alfa-4-(chloro-alpha-cyclopropylbenzylidenamino-oxy)-p-tolyl)-3-(2,6-diflourobenzoyl)urea, Diflubenzuron: N-(((3,5-dichloro-4-(1,1,2,2-tetraflouroethoxy)phenylamino) carbonyl)2,6 diflouro benzamid,

Triflumuron: 2-Chloro-N-(((4-(triflouromethoxy) phenyl)-amino-)carbonyl) benzamide, or a triazin such as N-cyclopropyl- 1,3,5 -triazine-2,4,6-triamin; and

the repellant is selected from N,N-Diethyl-meta-toluamide(DEET), N,N-diethylphenylacetamide (DEPA), 1-(3-cyclohexen-1-yl-carbonyl)-2-methylpiperine, (2-hydroxymethylcyclohexyl) acetic acid lactone, (2-ethyl-1,3-hexandiol), indalone, Methylneodecanamide (MNDA), a pyrethroid not used for insect control such as {(+/-)-3-allyl-2-methyl-4-oxocylopent-2-(+)enyl-(+)trans-chrysantemate (Esbiothrin), a repellant derived from or identical with plant extracts like limonen, citronella, eugenol, (+)-Eucamalol (1), (-)-1-epi-eucamalol or crude plant extracts from plants like Eucalyptus maculata, Vitex rotundifolia,Cymbopogan martinii, Cymbopogan citratus (lemon grass), Cymopogan nartdus (citronella), and

b) a film forming agent selected from paraffin oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, and polyflourocarbon derivatives and

the filmforming agent being capable of forming a continuous layer substantially enclosing the fibres of a fabric or of a netting.

10. A composition according to a claim 9 wherein the silicon oil or wax is a polysiloxan.

11. A composition according to claim 9 or 10 wherein the film forming component comprises a polymeric backbone selected from a resin, a polyurethane or a polyacryl.

12. A composition according to claim 11 wherein the paraffin oil or wax derivatives, silicon derivatives, silicon oils or wax derivatives, or polyflourocarbon derivatives is attached to the polymeric backbone.

13. A composition according to any of claims 9-12 further comprising one of more components selected from water, solvents, preservatives, detergents, stabilisers, agents having UV protecting properties, spreading agents, anti-migrating agents, preservatives, foam forming agents, and anti-soiling agents.

14. A composition according to any of claims 9-13 comprising from about 0.001 to 95 %, by weight, of the insecticide and/or a repellant.

15. A composition according to any of claims 9-14 which is provided as a kit for impregnation by the end-user.

16. A composition according to claim 15 wherein the composition in the kit is adapted for preparing a solution or emulsion by adding water.

17. A composition according to claim 16 wherein the composition in the kit is in the form of a dry composition such as a powder, a capsule, a tablet, or an effervescent tablet.

18. A process for impregnation of a fabric or a netting comprising

(a) forming a solution or a water emulsion of an insecticide and/or a repellant and a polymer and passing the fabric or netting through the solution or emulsion or spraying the solution or emulsion onto the fabric or netting at a temperature within a range of 10-120°C,

or

applying an insecticide and/or a repellant on the fabric or netting and passing the fabric through a polymer solution or emulsion

b) optionally removing surplus composition by pressing of the fabric or netting

c) drying the fabric passively or actively at a temperature within 20-150°C.

19. A process according to claim 18 wherein the emulsion is in the form of a foam.

20. A process according to claim 18 wherein the solution or emulsion further comprises ones or more ingredients selected from detergents, stabilisers, agents having UV protecting properties, solvents, spreading agents, anti-migrating agents, preservatives, foam forming agents, and soiling agents.

21. A process according to any of claims 18-20 wherein the impregnating composition is provided as a kit for impregnation by the end-user

22. A process according to claim 21 wherein the kit is adapted for preparing a solution or emulsion by adding water.

23. A process according to claim 21 or 22 wherein the kit is in the form of a dry composition such as a powder, a capsule, a tablet, or an effervescent tablet.

24. A process according to any of claims 18-22 wherein the impregnation is a re-impregnation of the fabric or netting.

INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/DK 00/00649

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01N25/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 382 382 A (ICI PLC) 16 August 1990 (1990-08-16) the whole document ---	1-23
X	WO 98 18998 A (SENECAL RENE E) 7 May 1998 (1998-05-07) the whole document ---	1-23
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
28 February 2001	23. 04. 2001

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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